

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

In the Matter of)	
)	
Use of Spectrum Bands Above 24 GHz For Mobile Radio Services)	GN Docket No. 14-177
)	
Establishing a More Flexible Framework to Facilitate Satellite Operations in the 27.5-28.35 GHz and 37.5-40 GHz Bands)	IB Docket No. 15-256
)	
Petition for Rulemaking of the Fixed Wireless Communications Coalition to Create Service Rules for the 42-43.5 GHz Band)	RM-11664
)	
Amendment of Parts 1, 22, 24, 27, 74, 80, 90, 95, and 101 To Establish Uniform License Renewal, Discontinuance of Operation, and Geographic Partitioning and Spectrum Disaggregation Rules and Policies for Certain Wireless Radio Services)	WT Docket No. 10-112
)	
Allocation and Designation of Spectrum for Fixed- Satellite Services in the 37.5-38.5 GHz, 40.5-41.5 GHz and 48.2-50.2 GHz Frequency Bands; Allocation of Spectrum to Upgrade Fixed and Mobile Allocations in the 40.5-42.5 GHz Frequency Band; Allocation of Spectrum in the 46.9-47.0 GHz Frequency Band for Wireless Services; and Allocation of Spectrum in the 37.0- 38.0 GHz and 40.0-40.5 GHz for Government Operation)	IB Docket No. 97-95

OPPOSITION OF T-MOBILE USA, INC.

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OPPOSITION OF T-MOBILE USA, INC.

T-Mobile USA, Inc. (“T-Mobile”),^{1/} pursuant to Section 1.429 of the rules,^{2/} submits this opposition in response to several of the Petitions for Reconsideration of the *Report and Order* released in the above-referenced proceedings on July 14, 2016.^{3/}

^{1/} T-Mobile USA, Inc. is a wholly-owned subsidiary of T-Mobile US, Inc., a publicly traded company.

^{2/} See 47 C.F.R. § 1.429; *Office of Engineering and Technology and Wireless Telecommunications Bureau Extend Period to File Oppositions and Replies in Response to Petitions for Reconsideration of*

I. INTRODUCTION AND SUMMARY

Recognizing that technological breakthroughs have made mobile terrestrial use of millimeter wave spectrum possible and desirable, the Commission took much needed action to promote Fifth Generation (“5G”) services in the *Report and Order* by making additional spectrum available for mobile terrestrial use.^{4/} Yet despite the Commission’s stated goals of facilitating increased terrestrial use of millimeter wave spectrum^{5/} and of promoting the deployment of corresponding 5G technologies,^{6/} and its determinations regarding the development of 5G mobile terrestrial services, several companies filed Petitions for Reconsideration that ask the Commission to limit future terrestrial mobile use of the millimeter wave bands.^{7/} Each of these petitions should be denied. Specifically, the Commission should reject:

- calls to increase Fixed Satellite Service (“FSS”) access to the 28, 37, and 39 GHz bands by altering the geographic limits on earth station siting or by modifying the technical parameters for Upper Microwave Flexible Use Service (“UMFUS”) operations;

Report and Order in Use of Spectrum Bands Above 24 GHz for Mobile Radio Services Proceeding, Public Notice, DA 17-50 (rel. Jan. 12, 2017) (extending the deadline for oppositions to January 31, 2017).

^{3/} *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, et al.*, Report and Order and Further Notice of Proposed Rulemaking, FCC 16-89, 31 FCC Rcd. 8014 (2016) (subparts referred to respectively as the “*Report and Order*” and the “*FNPRM*”).

^{4/} *See Report and Order*, ¶ 1.

^{5/} *See id.*, ¶ 50.

^{6/} *See id.*, ¶ 1.

^{7/} *See* Petition for Reconsideration of SES Americom, Inc. and O3b Limited, GN Docket No. 14-177 *et al.* (filed Dec. 14, 2016) (“SES and O3b Petition”); Petition for Reconsideration of the Satellite Industry Association, GN Docket No. 14-177 *et al.* (filed Dec. 14, 2016) (“SIA Petition”); Petition for Partial Reconsideration of ViaSat, Inc., GN Docket No. 14-177 *et al.* (filed Dec. 14, 2016) (“ViaSat Petition”); Joint Petition for Reconsideration of EchoStar Satellite Operating Corporation, Hughes Network Systems, LLC, and Inmarsat, Inc., GN Docket No. 14-177 *et al.* (filed Dec. 14, 2016) (“EchoStar and Inmarsat Petition”); Petition for Reconsideration of The Boeing Company, GN Docket No. 14-177 *et al.* (filed Dec. 14, 2016) (“Boeing Petition”).

- suggestions that it establish a database containing information on UMFUS station operations;
- requests to reconsider FSS downlink in the 42-42.5 GHz band; and
- proposals to impose additional emissions limits on UMFUS operations in the 28 GHz band.

II. THE COMMISSION SHOULD REJECT CALLS TO RECONSIDER ITS RULES FOR SATELLITE SHARING IN THE MILLIMETER WAVE BANDS.

The Commission should deny requests that it increase FSS access to the millimeter wave bands and establish a database containing information on UMFUS deployments. These proposals are contrary to the purpose of the proceeding and the public interest, are unnecessary, and have already been addressed and rejected in the *Report and Order*. Proponents of these requests do not demonstrate why the Commission's decisions on these issues were flawed.

A. Increased FSS Access to the 28, 37, and 39 GHz Bands Should Be Denied.

FSS proponents ask the Commission to revisit its determinations regarding satellite sharing in the 28, 37 and 39 GHz bands, in order to allow for increased satellite use of the bands. Specifically, SES, O3b, Boeing, Inmarsat, EchoStar, and the SIA ask for expanded access to the 28 GHz band; and Boeing, Inmarsat, EchoStar, and the SIA also ask the Commission to reevaluate its rules regarding satellite use of the 39 GHz band.^{8/} Boeing further seeks additional satellite access to the 37 GHz band.^{9/} The increased access the FSS proponents seek would be achieved in one of two ways – by altering the geographic limits on earth station siting or by modifying the technical parameters for UMFUS operations. The Commission should do neither and should deny the requests.

^{8/} See, e.g., SES and O3b Petition at 2-3; Boeing Petition at 5-20, 23-25; EchoStar and Inmarsat Petition at 11-21; and SIA Petition at 5-11.

^{9/} See Boeing Petition at 5-20, 23-25.

The primary purpose of this proceeding is to make additional spectrum available for 5G mobile terrestrial operations.^{10/} As the Commission made clear, “demand for mobile service that [millimeter wave] spectrum is expected to enhance and improve has been increasing[,]”^{11/} and therefore, the rules it adopted are intended “to facilitate expanded terrestrial use” of this spectrum.^{12/} Requests for increased satellite access are therefore contrary to the purpose of this proceeding. Any increased use of the spectrum for satellite operations means decreased utility of the spectrum for mobile terrestrial use. And, decreased utility of the spectrum for its primary intended purpose will depress investment in, and ultimately the success of, mobile use of these bands. The Commission must not sacrifice the deployment of mobile terrestrial services in the millimeter wave bands to meet unproven needs for satellite broadband.

Moreover, none of the requests FSS proponents make or arguments they present are new. The Commission already considered them in the *Report and Order* and correctly rejected them because they would negatively impact the ability of terrestrial mobile licensees to provide service. The Commission has repeatedly stated that it will not grant petitions for reconsideration that merely re-hash arguments made in an earlier phase of the proceeding.^{13/} Accordingly, the FSS proponents’ requests should be denied. Each request is discussed further below.

^{10/} See *Report and Order*, ¶ 1 (“[Millimeter wave] frequencies previously have been best suited for satellite or fixed microwave applications; however, recent technological breakthroughs have newly enabled advanced mobile services in these bands, notably including very high speed and low latency services. To promote the deployment of these highly beneficial technologies, we are acting quickly[.]”); *id.*, ¶ 7 (discussing 5G mobile wireless technologies and stating that “[m]oving quickly to make this spectrum available in the near term will best enable potential users, technology developers, and innovators to have relative certainty about the spectrum structure in the mmW bands for these new uses”).

^{11/} *Id.*, ¶ 183.

^{12/} *Id.*, ¶ 50; see also *id.*, ¶ 76 (“We believe that the significant bandwidth available in [the 39 GHz] band will help to accommodate the expected continued rise in demand for mobile data.”).

^{13/} *Ensuring Continuity of 911 Communs.*, Order on Reconsideration, 31 FCC Rcd. 10131, 10132 (2016) (“It is by now well settled that the Commission will not consider a petition for reconsideration that merely repeats arguments that the Commission has previously rejected.”); *General Motors Corporation*

Limits on Satellite Earth Station Siting in the 28, 37, and 39 GHz Bands. SES, O3b, Boeing, Inmarsat, EchoStar, and the SIA each ask the Commission to reconsider the geographic limitations on future authorization of FSS earth stations. Each of them contends, for instance, that the limits will make FSS deployment in rural areas less likely.^{14/} These claims are speculative, based mainly on the simple proposition that in a rural county or Partial Economic Area (“PEA”) with a smaller population, the 0.1% population limitation would be triggered by a site that impacts only a small number of people. This argument neither presents new evidence regarding rural deployments nor undermines the Commission’s reasoning for adopting the 0.1% metric. Rural and remote counties and PEAs, for instance, are more likely to contain areas where there are no people at all, meaning that satellite operators will easily satisfy the 0.1% threshold. Moreover, as the Commission pointed out, “satellite operators can substantially reduce the sizes of the exclusion zones that they require by constructing artificial site shields or by taking advantage of naturally occurring terrain features.”^{15/} Both of these possibilities would allow FSS operators to deploy earth stations that would impact 0% of an area’s population.

Further, as noted above, the primary purpose of this proceeding is to make spectrum available for 5G mobile terrestrial operations, and any additional satellite use of the bands will threaten the viability of the spectrum for mobile terrestrial use. Accordingly, the *Report and*

and Hughes Electronics Corporation, Order on Reconsideration, 23 FCC Rcd. 3131, 3135 (2008) (“The Commission previously has rejected arguments on reconsideration where the petitioner ‘presented no new evidence that would cause us to reconsider our prior determinations.’ Further, the Commission has rejected petitions for reconsideration where the petitioner ‘essentially repeats the same arguments it relied upon in the comments and reply comments it filed’ and ‘fails to raise new arguments or facts that would warrant reconsideration of [the underlying] order.’”).

^{14/} See SIA Petition at 11; SES and O3b Petition at 6-7; Boeing Petition at 23-25; EchoStar and Inmarsat Petition at 17.

^{15/} *Report and Order*, ¶ 92; see also *id.*, ¶ 55 (noting that an interference zone “could be reduced further by reducing the preclusive distance around the earth station, using mitigation techniques such as shielding”).

Order states that the 0.1% siting standard is only meant to provide for earth station deployment without additional interference protection to UMFUS licensees “in limited circumstances.”^{16/} Given these stated goals, the Commission is not required – as suggested by FSS proponents – to perform any analysis in the 28, 37, or 39 GHz bands to determine whether the siting limitations would “unreasonably constrain the number of suitable siting locations for GSO and NGSO earth stations.”^{17/} Nor is the Commission required to consider SES, O3b, EchoStar, and Inmarsat’s argument that the requirement that an interference zone not “infringe upon any major event venue, arterial street, interstate or U.S. highway, urban mass transit route, passenger railroad, or cruise ship port”^{18/} is overly restrictive and prevents satellite earth stations from accessing broadband infrastructure.^{19/} The Commission determined that these are areas in which it “could expect to have high demand for wireless services,”^{20/} and the limitations are therefore consistent with the Commission’s goals in this proceeding. Moreover, as noted below, satellite operators remain free to take advantage of market mechanisms in order to secure siting locations in these areas.^{21/}

SES and O3b also argue that the method the Commission used to derive the 0.1% population standard in the 28 GHz band is flawed because a “0.08 square kilometer

^{16/} *Report and Order*, ¶ 53.

^{17/} See SES and O3b Petition at 5; see also EchoStar and Inmarsat Petition at 16 (“Nor did the Commission or any other party make any serious attempt to determine the extent to which FSS operations would be limited by having to avoid 99.9% of all population in every license area.”)

^{18/} *Report and Order*, ¶ 50.

^{19/} See EchoStar and Inmarsat Petition at 9-10; SES and O3b Petition at 14-15.

^{20/} *Report and Order*, ¶ 54.

^{21/} See *id.*, ¶ 46; see also *id.*, ¶ 92 (discussing the 39 GHz band and stating that “satellite operators may continue to protect their earth stations from interference using any of four market-oriented mechanisms: purchasing geographic area licenses at auction, acquiring licenses from existing licensees, obtaining partitioned segments of existing geographic area licenses from existing licensees, or obtaining contractual agreements from nearby licensees not to interfere into their earth station operations”).

[interference] zone cannot be considered to be typical even for GSO systems.”^{22/} The record, however, clearly supports the Commission’s methodology for calculating this interference zone. EchoStar and ViaSat both estimated that “terrestrial mobile stations could be deployed as close as 170 meters to their Earth-to-space transmitters in the 28 GHz band.”^{23/} The Commission then used ViaSat’s 160-meter radius estimate as a point of departure, and based on this, calculated that “the typical interference zone for terrestrial operations around a gateway earth station would cover about 0.08 square kilometers.”^{24/}

SES and O3b further argue that “the [Commission’s] calculation only considered the size of a GSO earth station coverage area and failed to consider that NGSO earth stations will produce a larger coverage area for limited portions of time[,]”^{25/} and that the adopted rules make it “impossible for NGSO earth stations . . . to find any suitable locations.”^{26/} Neither of these assertions is correct. The *Report and Order* directly addresses NGSO earth stations, “recogniz[ing] that sharing may be more difficult for non-geostationary satellite systems” and acknowledging that “O3b estimates that the preclusive distance for its gateway earth stations with respect to mmW mobile stations is between 1.2 and 13.8 kilometers.”^{27/} In any case, such

^{22/} SES and O3b Petition at 6.

^{23/} *Report and Order*, ¶ 50; see also Comments of EchoStar Satellite Operating Corporation, Hughes Network Systems, LLC, and Alta Wireless, Inc., GN Docket No. 14-77 *et al.*, at 16 (filed Jan. 27, 2016) (“For example, using the 5G parameters submitted in this proceeding by Samsung and a conservative path loss model (assuming free space loss plus 20 dB additional discrimination), the required coordination distance between a transmitting gateway and a mobile base station in this band would be approximately 170 meters.”); Comments of ViaSat, Inc., GN Docket No. 14-77 *et al.*, at i-ii, 13-14, Exhibit 1 (filed Jan. 28, 2016) (if the 5G interference threshold were set at the 47 dBuV/m specified in Part 27 of the Commission’s rules, any areas of incompatibility would likely occur in an area no more than about 160 meters from the earth station, and that area could be further reduced by shielding).

^{24/} *Report and Order*, ¶ 55

^{25/} SES and O3b Petition at 6.

^{26/} *Id.* at 8.

^{27/} *Report and Order*, ¶ 46.

satellite operators “[have] the option of locating future earth stations in relatively remote areas”; “can obtain protection by purchasing an exclusive use terrestrial license at auction or by working with a licensee in the secondary market to partition a license area . . . or enter into a different type of negotiated sharing arrangement”; and “can take advantage of shielding or other mitigation techniques.”^{28/}

The baselessness of the FSS proponent’s criticisms with respect to the 28 GHz band in particular is further highlighted by the fact that satellite operators have no reasonable expectation of use in this band in a manner that would impinge on mobile terrestrial use.^{29/} Satellite use of the 28 GHz band was “secondary with respect to LMDS under Commission rules, and the *Second LMDS Report and Order* had put [satellite operators] on notice that mobile service might eventually be authorized in the 28 GHz band.”^{30/} For this same reason, the Commission should reject the SIA’s re-hashed argument that satellite operators had a reasonable expectation of any primary or co-primary status in the band.^{31/}

Finally, SES and O3b challenge the 0.1% limitation based on assumptions about how the Commission will calculate the 0.1% metric.^{32/} Those arguments are premature. The International Bureau, at the Commission’s direction, will issue a public notice seeking comment on the appropriate methodology to calculate the 0.1% population limit.^{33/} Until the measurement methodology is determined, there is no basis for challenging the limit.

^{28/} *Report and Order*, ¶ 46.

^{29/} *See id.*, ¶ 21 (The Commission in the *NPRM* “found that the prospect of mobile service in the band should not thwart any reasonable expectations of satellite operators[.]”).

^{30/} *See id.*

^{31/} SIA Petition at 5-7.

^{32/} *See, e.g.* SES and O3b Petition at 8.

^{33/} *Report and Order*, ¶ 55. EchoStar and Inmarsat also re-propose the siting and coordination regime EchoStar proposed with AT&T prior to the release of the *Report and Order*. *See* EchoStar and

Lower Base Station Power Limit for UMFUS. Boeing asks the Commission to reconsider the power limits it adopted for UMFUS base stations operating in the 28, 37, and 39 GHz bands and to lower the limit from 75 dBm to 62 dBm.^{34/} Boeing argues that the Commission ignored the record in support of the lower limit, failed to provide an appropriate justification for the higher limit adopted, and failed to consider the impact of the limit adopted on spectrum sharing with satellite operations in the 37 and 39 GHz bands.^{35/} None of these assertions are correct.

First, the Report and Order actually adopted an equivalent isotropically radiated power (“EIRP”) limit of 75 dBm/100 MHz EIRP,^{36/} not just a power limit of 75 dBm, and the *Report and Order* details at length why the Commission selected the higher power limit over the lower one initially proposed. Most commenters – including Qualcomm Incorporated, Samsung Electronics America, Inc., Straight Path Communications Inc., Verizon Communications, Inc., Ericsson, Nokia, the Telecommunications Industry Association, and XO Communications, LLC – demonstrated why a higher limit is appropriate.^{37/} As the Commission noted, commenters “provide[d] many reasons why higher power limits will be advantageous for 5G systems” – for instance, additional power increases link reliability; higher power limits enable larger base station footprints and account for the larger number of antennas and higher bandwidths in the 28 and 39 GHz bands; and the proposed power limits were significantly less than what has been

Inmarsat Petition at ii, 15-20. The Commission considered and rejected this proposal in the *Report and Order*, and EchoStar and Inmarsat present no new evidence that could cause the Commission to reconsider. *See Report and Order*, ¶ 60.

^{34/} Boeing Petition at 7.

^{35/} *Id.* at 7-9.

^{36/} *See Report and Order*, ¶ 277.

^{37/} *See id.*, ¶ 271.

traditionally allowed in the millimeter wave bands.^{38/} A technical analysis submitted by Nokia, and cited by the Commission, also showed higher power density levels than 62 dBm/100 MHz are necessary for the UMFUS to have meaningful cell coverage areas.^{39/}

Further, the Commission's rules allow Personal Communications Service ("PCS") and Advanced Wireless Services ("AWS") base stations to transmit at 62 dBm/MHz EIRP, permitting a total EIRP of 82 dBm for a 100 MHz signal in those bands. A 75 dBm/100 MHz EIRP for UMFUS brings the UMFUS power density closer to that of PCS and AWS, but it is still 7 dB lower than is the allowed in the PCS and AWS bands. Considering the millimeter wave bands' higher propagation losses and attenuations due to obstacles in these bands,^{40/} it is clear that even the 75 dBm/100 MHz power density is restrictive on UMFUS and will result in areas covered by UMFUS cells that are smaller than is possible in the PCS and AWS bands, particularly given the comparative propagation characteristics of the bands.

In short, the record contains considerable support for the Commission's findings that a higher power limit is necessary because of "the propagation properties in the mmW band" and because a 62 dBm/100 MHz EIRP would "limit UMFUS base stations to a much lower power density than is permitted for other mobile services."^{41/} And even if it is the case, as Boeing asserts, that the majority of 5G proponents have detailed plans at this time that would use lower power levels than adopted, the Commission correctly determined that "[u]nnecessarily limiting

^{38/} See *Report and Order*, ¶ 272 (citing to comments from XO, Qualcomm, and Straight Path).

^{39/} See Nokia *NPRM Comments* at 26-27; *Report and Order*, ¶ 273.

^{40/} See also *Report and Order*, ¶ 276 ("Signal attenuation with distance is higher in the mmW bands than at lower frequencies and signals are more severely attenuated due to obstacles such as foliage and walls.").

^{41/} *Id.*

the base station power in the mmW bands . . . could unduly inhibit future technologies and applications.”^{42/}

Second, it was not inconsistent for the Commission to dismiss Boeing’s concerns regarding satellite end user terminals in the 37 and 39 GHz bands, citing the deployment prohibition contained in the existing rules, while also seeking comment in the *FNPRM* on whether it is feasible to lift the prohibition.^{43/} As discussed above, the primary purpose of this proceeding is to make spectrum available for mobile terrestrial use, and the Commission’s actions are consistent with that purpose. Any additional analysis on satellite user equipment in these bands must take into account the new UMFUS rules. Because Boeing provides no new information regarding base station power limits and the Commission has already addressed Boeing’s arguments, Boeing’s request should be denied.

Use of Total Radiated Power (“TRP”) Metric. Boeing asks the Commission to clarify its rules and adopt TRP density specifications applicable to all UMFUS in-band emissions.^{44/} The Commission should reject this request. As Boeing acknowledges, the rules adopted “correctly and effectively limit[] the maximum directional power density of an UMFUS base station emission[,]”^{45/} and as discussed in detail below, the Commission found that mobile terrestrial operators are likely to use beamforming^{46/} in order to generate highly directional beams that will overcome the propagation losses inherent in the millimeter wave bands, preventing interference to nearby receivers. Moreover, the Commission has routinely used a maximum EIRP metric to

^{42/} *Report and Order*, ¶ 276.

^{43/} *See* Boeing Petition at 9.

^{44/} *See id.* at 10.

^{45/} *See id.* at 9.

^{46/} *See Report and Order*, ¶ 65.

set a transmitter's maximum radiated power limit in wireless systems. In light of this, a TRP density specification applicable to UMFUS in-band emissions is unnecessary.

Specific Beamforming and Power Control Requirements for UMFUS. Boeing asks that the Commission reconsider adopting beamforming and power control requirements for UMFUS in the 37 and 39 GHz bands.^{47/} Boeing contends that, because of the discussion in the record of beamforming and power control and the “Commission’s acknowledgement that spectrum sharing is feasible in the 37/39 GHz band, it would be arbitrary and unreasonable for the Commission to conclude that it need not consider Boeing’s proposal to codify beamforming and power control requirements for the 37/39 GHz band” and “insufficient for the Commission to conclude . . . that the benefits of beamforming and power control are likely to occur in the 37/39 GHz band absent regulation.”^{48/} The Commission should reject these arguments.

As Boeing acknowledges, the Commission found that mobile terrestrial operators are likely to deploy dynamic beamforming and power control on their own,^{49/} and that UMFUS licensees “have every incentive to design networks that direct the signals they are transmitting to the locations of the receivers . . . especially given the propagation characteristics of these frequencies.”^{50/} Boeing further admits that the terrestrial mobile industry has discussed the importance of beamforming and power control.^{51/} In fact, equipment manufacturers have contemplated beamforming (off-axis) requirements that are more stringent than what Boeing has proposed. Despite this recognition, Boeing insists – without justification or a supporting

^{47/} See Boeing Petition at 12.

^{48/} *Id.* at 17

^{49/} See *Report and Order*, ¶ 65.

^{50/} See *id.*, ¶ 67.

^{51/} Boeing Petition at 10-13.

technical analysis – that it is still necessary for the Commission to adopt specific requirements for beamforming and power control. However, there is no additional benefit from a Commission mandate on this issue. To the contrary, adopting the suggested requirements at this early stage would freeze in place particular technological requirements and potentially hamstring the robust development of 5G technologies. The Commission rightly concluded that “given the wide variety of deployments and uses we expect to see in these bands, it would be inappropriate to universally mandate these design features in *every* deployment.”^{52/} In addition, the Commission’s decision is consistent with precedent, in which it has refrained from making technology decisions and allowed industry to develop best practices. It should retain this approach here and leave defining specific requirements like the beamforming (off-axis) requirement proposed by Boeing to standards bodies like the 3rd Generation Partnership Project.

Prohibition on the Use of Omni-Directional Antennas in the 28, 37, and 39 GHz

Bands. Boeing further requests that the Commission prohibit the use of omni-directional antennas for fixed point-to-multipoint communications in the 28, 37, and 39 GHz bands.^{53/}

Boeing’s rationale is flawed. The rules to which Boeing objects relate to fixed operations. However, as Boeing recognizes, the “vast majority of UMFUS systems will communicate with more than one point.”^{54/} That is because – as Boeing does not acknowledge – most fixed stations will communicate with mobile units and will not necessarily operate in point-to-multipoint mode. In addition, the omni-directional antennas to which Boeing objects are already permitted for base-to-mobile use.

^{52/} *Report and Order*, ¶ 67 (emphasis added).

^{53/} *See* Boeing Petition at 20-21.

^{54/} *Id.* at 20.

Boeing is wrong when it says that high-power omni-directional antennas (presumably used in a point-to-multipoint configuration) will “preclude highly beneficial UMFUS services.”^{55/} UMFUS licensees will be able to manage frequency use to facilitate both mobile and point-to-multipoint fixed services, as market developments demand. Further, because the authorized EIRP density limit is already set, if an operator decides to use an omni-directional antenna, the total radiated power would be evenly distributed over all directions, which would make the power density in any given direction from the omni-directional antenna much less than the power density at the boresight of a corresponding directional antenna. This is contrary to Boeing’s claim that the omni-directional antenna “would blanket the area, overwhelming victim receivers that attempt to communicate with other systems.”^{56/}

Finally, limiting a UMFUS licensee’s ability to provide a particular service is contrary to the public interest. Technology in the millimeter wave bands is still developing and there is no reason the Commission should unnecessarily constrain its evolution. Limitation on the type of operations that a licensee can offer is inconsistent with the Commission’s geographic area licensing approach.

As the above demonstrates, the arguments raised by the FSS proponents with regard to increased access to the millimeter wave bands have already been considered by the Commission and discussed in the *Report and Order*, and the FSS proponents have not presented any new basis for challenging the Commission’s determinations. The Commission should therefore reject each of these requests.

^{55/} Boeing Petition at 21.

^{56/} *Id.* at 21.

FSS Requests for Additional Spectrum Access Are Baseless. The FSS proponents' requests for additional access to the 28, 37, and 39 GHz bands are based on the faulty premises that the satellite industry needs millimeter wave spectrum in order to offer broadband services and that the Commission unreasonably favored terrestrial services in the *Report and Order*. For instance, Boeing claims that the Commission must reconsider aspects of the *Report and Order* "to provide the regulatory certainty necessary to support private sector investment in global broadband satellite systems."^{57/} SIA argues that "satellite networks will inevitably play an important independent and complementary role to terrestrial networks in the provision of broadband in [the 28 and 39 GHz] bands" and that "it is essential that the various spectrum band dynamics under consideration at this early stage of this proceeding encourage cooperation among all parties within the Commission's established priorities."^{58/} These arguments suffer two fatal flaws.

First, as demonstrated above, satellite broadband and its alleged needs were not before the Commission in this proceeding – the Commission's "established priority" in this proceeding was (and continues to be) making additional spectrum available for mobile terrestrial operations. Therefore, there is no reason for the Commission to reconsider whether spectrum should be made available for broadband satellite use.

Second, if the Commission had considered that issue, it would not have found any basis for dedicating valuable spectrum to satellite operations. Most Americans do not use satellite services for broadband access.^{59/} A study released last year showed that there are only 1.8

^{57/} Boeing Petition at 2.

^{58/} SIA Petition at 3.

^{59/} See *Ex Parte* Presentation of Straight Path Communications Inc., GN Dkt. No. 14-177 *et al.*, at 4-5 (filed July 7, 2016) ("A survey from the NTCA – The Rural Broadband Association found that among

million satellite broadband subscriptions in the entire world,^{60/} compared to approximately 375.5 million mobile broadband subscriptions in the U.S. alone.^{61/} Moreover, 5G terrestrial services are still being developed, and they have the potential to expand terrestrial services’ already significant reach.

Further, there has been no effort on behalf of existing satellite systems to actually use the vast amount V-band spectrum available to them already. The V-band has been available for satellite use for over a decade, and yet as Boeing has stated, the V-band is still considered merely a “near-term growth band for the broadband satellite industry.”^{62/} In addition, as the recently filed Fixed Wireless Communications Coalition Petition for Rulemaking shows, satellite operators are not even using the capacity for which they are licensed – they coordinate operations for “full-band, full-arc” operations when it is not required.^{63/}

In contrast, the terrestrial mobile industry has been and is putting its available spectrum to use meeting the demand created by consumer use of data over mobile wireless networks. The growing consumer demand for mobile terrestrial network capacity is well documented,^{64/} and as the Commission recognizes, the “[millimeter wave] bands could be particularly useful in

the ‘more than 128 rural telecom and cable companies’ that were surveyed by the NTCA, ‘satellite was cited by less than a fraction of 1 percent of respondents’ as the technology for broadband services.”).

^{60/} See SATELLITE INDUSTRY ASSOCIATION, 2016 STATE OF THE SATELLITE INDUSTRY REPORT 2 (2016), <http://www.sia.org/wp-content/uploads/2016/06/SSIR16-Pdf-Copy-for-Website-Compressed.pdf>.

^{61/} See *Broadband Portal, Total Fixed and Wireless Broadband Subscriptions by Country*, Organisation for Economic Co-operation and Development (Aug. 2016) (data available in a downloadable chart), www.oecd.org/sti/broadband/oecdbroadbandportal.htm.

^{62/} Opposition and Response of The Boeing Company, IBFS File No. SAT-LOA-20160622-00058, at 28 (filed Dec. 12, 2016).

^{63/} Fixed Wireless Communications Coalition Petition for Rulemaking (filed Oct. 11, 2016); see also *Consumer and Governmental Affairs Bureau Reference Information Center, Petitions for Rulemaking Filed*, Public Notice (rel. Dec. 9, 2016).

^{64/} See *Report and Order*, ¶ 7; see also T-Mobile USA Inc. Reply to Oppositions and Response, IBFS File No. SAT-LOA-20160622-00058, at 7-8 (filed Dec. 19, 2016); Comments of T-Mobile USA, Inc., GN Docket No. 14-177 *et al.*, at 3-6 (filed Sept. 30, 2016).

supporting very high capacity networks in areas that require such capacity.”^{65/} The requests by the satellite industry, however, would *decrease* the utility of millimeter wave spectrum for mobile terrestrial use. While there may be small rural areas that would be better or more quickly served by satellite broadband, it would be contrary to the public interest and the purpose of the proceeding to inhibit terrestrial mobile services’ use of these bands nationwide in order to benefit only a small fraction of the public. The petitions’ requests for increased access to the 28, 37, and 39 GHz bands should therefore be denied.

B. The Commission Need Not Establish a UMFUS Database.

The Commission should also reject suggestions from SES, O3b, EchoStar, and Inmarsat that it establish a mechanism, such as a Commission-maintained database, with information on where UMFUS stations are operating.^{66/} Such a requirement would be overly burdensome on UMFUS operators – who would be required to maintain information for each license area regardless of whether an FSS operator is interested and able to site an earth station in that license area – while providing a modest convenience benefit to satellite operators. Existing licensing databases already identify licensees in a particular geographic area, and satellite licensees can contact listed UMFUS licensees as required. Moreover, a database with information about licensee deployment is inconsistent with the Commission’s treatment of almost all other commercial wireless services, limiting deployment flexibility and revealing potentially confidential information about coverage strategies. Further, because millimeter wave spectrum will likely be used to support Internet of Things (“IoT”) applications, with over 30 *billion* IoT devices expected to be deployed in the next three years, implementation of a database – even if it

^{65/} *Report and Order*, ¶ 7.

^{66/} *See* SES and O3b Petition at 17-18; EchoStar and Inmarsat Petition at 21-22.

just includes UMFUS licensees' facilities – may be impractical.^{67/} Finally, establishment of such a database was not raised in the record of this proceeding, even though satellite and UMFUS sharing and the processes for future earth station siting were subject to considerable discussion.^{68/} The Commission cannot on reconsideration adopt rules to address a new issue that could have been, but was not, presented to it during the proceeding.^{69/} It should therefore deny this request.

III. THE COMMISSION SHOULD DENY REQUESTS TO RECONSIDER FSS DOWNLINK IN THE 42-42.5 GHZ BAND.

ViaSat and Boeing ask the Commission to reconsider its decision not to allocate the 42-42.5 GHz band for FSS downlink operations, citing record support for an FSS allocation and a need for more downlink spectrum to support broadband satellite systems.^{70/} The Commission should deny these requests for several reasons.

^{67/} See, e.g., SAM LUCERO, IHS TECHNOLOGY, IOT PLATFORMS: ENABLING THE INTERNET OF THINGS 5 (2016) (“IHS forecasts that the IoT market will grow from an installed base of 15.4 billion devices in 2015 to 30.7 billion devices in 2020 and 75.4 billion in 2025[.]”).

^{68/} See, e.g., CTIA *Ex Parte*, GN Dkt. No. 14-177 *et al.*, at 4 (filed May 20, 2016) (proposing a sharing framework and stating in its proposal that “sharing [outside top-150 Metropolitan Statistical Areas] will be based on coordination guidelines and protection zones that are still the subject of active discussion among UMFU and FSS stakeholders”); EchoStar Satellite Operating Corporation, Hughes Network Systems, LLC, Inmarsat, Inc., O3b Limited, SES Americom, Inc., ViaSat, Inc., and WorldVu Satellites Ltd./OneWeb *Ex Parte*, GN Dkt. No. 14-177 *et al.*, at 5 (filed May 26, 2016) (proposing that “FSS operators should presumptively be entitled to deploy individually-licensed earth stations in [certain] areas without coordination as long as there is no existing UMFU deployment and where doing so is not likely to materially impair UMFU deployment already planned”).

^{69/} See 47 C.F.R. § 1.429(l)(2) (providing that “[p]etitions for reconsideration of a Commission action that plainly do not warrant consideration by the Commission . . . include, but are not limited to, petitions that . . . [r]ely on facts or arguments which have not previously been presented to the Commission” and are not either (i) facts or arguments that were previously unknown and could not have been discovered with ordinary diligence, or (ii) facts or arguments that relate to new or changed circumstances); see also *Connect Am. Fund, Universal Serv. Reform Mobility Fund et al.*, 29 FCC Rcd. 16152, ¶ 10 (2014) (dismissing a petition for reconsideration because the issues raised in it had “not been raised in the record and the Commission . . . had no opportunity to address [the] arguments”).

^{70/} Boeing Petition at 21-22; ViaSat Petition at 5, 7-8.

First, the Commission is not obligated to adopt every proposal suggested in a rulemaking proceeding.^{71/} As ViaSat notes, the Commission did not propose FSS use of the band in the *Notice of Proposed Rulemaking*.^{72/} Rather, the satellite industry proposed allocation of the band for FSS use in response to the Commission's general request for comment on the relative merits of FS, FSS, or mobile use, and possibilities for shared use in the band.^{73/} It was not a legal or factual error for the Commission to exercise its discretion by declining to make new allocations in the 42-42.5 GHz band.

Second, ViaSat's and Boeing's requests are premature. The 42-42.5 GHz band remains under consideration in the *FNPRM* in this proceeding,^{74/} and merely because the Commission declined to make it available for FSS in the *Report and Order* does not mean the Commission has forever foreclosed the use of the band for FSS.

Third, even if the decision not to dedicate the 42-42.5 GHz band for satellite use were subject to the criteria for petitions for reconsideration, the Commission validly determined that there was "less reason to further expand FSS operations to the 42 GHz band"^{75/} given existing FSS access in the 40.5-42 GHz band and the additional access to spectrum granted in the *Report and Order*. Contrary to ViaSat's arguments,^{76/} the Commission did in fact enhance satellite

^{71/} See, e.g., *Action for Children's Television v. FCC*, 564 F.2d 458, 481 (D.C. Cir. 1977) ("The Commission did not act arbitrarily or otherwise abuse its broad discretion in declining to adopt ACT's proposed rules as its own, or, for that matter, in declining to adopt any rules whatsoever for the time being. It has set forth its views in this area in a thorough and detailed manner. Its *Report* manifests a reasoned consideration of the issues raised during these proceedings and contains clearly stated conclusions which justify the approach taken.").

^{72/} See ViaSat Petition at 4; *Report and Order*, ¶ 366.

^{73/} See ViaSat Petition at 4; *Report and Order*, ¶ 366.

^{74/} See *FNPRM*, ¶ 403.

^{75/} *Report and Order*, ¶ 368.

^{76/} See ViaSat Petition at 8 ("In fact, the Spectrum Frontiers Order significantly diminished satellite access to the 37.5- 40 GHz band segment.").

access to the 37.5-40 GHz band. Prior to the *Report and Order*, gateway earth stations in the 39 GHz band could be deployed only if the FSS licensee obtained a 39 GHz license for the area where the earth station was located, or if the FSS licensee entered into an agreement with the corresponding 39 GHz licensee. The *Report and Order* retains this option and provides for a mechanism for access *in addition* to the previously existing market-oriented mechanisms.^{77/}

Fourth, Boeing and ViaSat provide no new information that would alter the Commission's correct conclusion that the enhanced satellite access to the 37.5-40 GHz band granted, combined with the fact that FSS has access to the 40.5-42 GHz band – currently unused – means that there is no need to expand FSS operations to the 42 GHz band.

Finally, as discussed in detail above, the satellite proponents have not demonstrated a need for additional capacity, while terrestrial mobile interests have shown a clear need. Thus, the Commission should deny ViaSat's and Boeing's requests that it reconsider its decision on the 42-42.5 GHz band.

IV. UMFUS WILL NOT CAUSE HARMFUL INTERFERENCE INTO SATELLITES IN THE 28 GHZ BAND AND ADDITIONAL EMISSIONS LIMITS ARE THEREFORE UNNECESSARY.

The *Report and Order* correctly concluded that the satellite industry had failed to establish that aggregate emissions of UMFUS operations is likely to cause harmful interference to satellites.^{78/} SES, O3b, and the SIA all ask that the Commission reconsider this decision and adopt rules governing UMFUS interference into satellites.^{79/} The Commission should deny SES's, O3b's, and the SIA's requests because they (i) present no new evidence, (ii) are

^{77/} See *Report and Order*, ¶¶ 92-93.

^{78/} See *id.*, ¶ 294.

^{79/} See SES and O3b Petition at 19-24; SIA Petition at 11-13.

premature in light of the Commission’s instructions in the *Report and Order*, and (iii) are based on a misstatement of international law.

First, SES, O3b, and the SIA provide no new analysis regarding harmful interference – instead merely rearguing points the Commission has already considered and rejected. SES and O3b, for instance, contend that in light of the early state of 5G development in the 28 GHz band, “the ‘worst case scenario’ is the only objective reference for what conditions should be anticipated”^{80/} and that therefore, the Commission should have “afforded greater weight to the technical analyses by O3b and others showing that relatively modest numbers of UMFUS transmitters within a satellite receive beam could cause harmful interference” without mitigating rules.^{81/} The Commission, however, rejected O3b’s and others’ “worst case scenario” analyses as improper, finding that although “[millimeter wave] mobile is a new, rapidly evolving technology, and the terrestrial mobile industry is still developing system designs and propagation models . . . there has been substantial progress in that regard[.]”^{82/} The interference models submitted should therefore have “take[n] into account prospective features of [millimeter] mobile systems that are readily accessible on the public record,” such as beamforming, power control, downtilts, traffic patterns, number of simultaneously transmitting stations, obstruction losses that terrestrial signals are likely to encounter before reaching satellites at low elevations, and the fact that the majority of transmissions will occur indoors.^{83/} In addition, the Commission noted that “mobile units, which are likely to be transmitting at angles more skyward, are

^{80/} SES and O3b Petition at 23.

^{81/} *Id.* at 22.

^{82/} *Report and Order*, ¶ 67.

^{83/} *Id.*

operating at powers significantly lower than base stations[.]” which is true “regardless of the types of systems that are ultimately deployed in these bands.”^{84/}

Thus, the operating characteristics on which the Commission based its assessment were not “sheer speculation,”^{85/} but predictive judgments based on academic studies, technical analyses conducted by the mobile terrestrial industry, and expected use cases.^{86/} The Commission did not simply conclude that “mobile providers ‘can’ take measures to avoid pointing emissions skyward”^{87/} but rather that the technologies deployed will likely take these measures, and that any analysis of harmful interference that does not account for these factors would not accurately reflect the real-world interference environment. Therefore, and in order to allow the greatest amount of innovation in 5G technologies, the Commission correctly concluded that “it would be inappropriate to universally mandate these design features in *every* deployment, in the absence of more credible support for the proposition that satellite systems will receive harmful interference from mmW mobile systems.”^{88/} The Commission should therefore deny proposals that it reconsider its decision and establish aggregate emission limits for UMFUS operations.

Second, any request that the Commission reconsider its decision on aggregate interference is premature.^{89/} The Commission directed the International Bureau, Office of

^{84/} *Report and Order*, ¶ 67.

^{85/} SES and O3b Petition at 20-21.

^{86/} *See Report and Order*, ¶¶ 65-67.

^{87/} SES and O3b Petition at 21.

^{88/} *Report and Order*, ¶ 67 (emphasis added).

^{89/} *See* SES and O3b Petition at 23 (“The Commission should make UMFUS authorizations subject to the resolution of the technical and regulatory issues implicated by aggregate interference into FSS satellites. Furthermore, UMFUS authorizations should include a condition requiring the licensee to take any and all steps necessary to eliminate harmful interference, including immediate cessation of transmissions from UMFUS stations within the receive beam of an FSS satellite.”).

Engineering and Technology, and Wireless Telecommunications Bureau to establish a separate docket that parties can use to file appropriate data and analyses.^{90/} If the Commission makes any additional assessment of aggregate interference into satellites, it should do so there, and only as a result of additional, robust data.

Last, the international obligations satellite proponents claim compel the Commission to take action regarding aggregate interference to protect FSS reception are misstated. The SIA suggests that, in order to ensure compliance with the United States' treaty obligation to protect foreign-authorized satellites, the Commission must adopt the maximum transmit power level of 10 dBW (40 dBm) per base station specified in RR No. 21.5 of the ITU Radio Regulations.^{91/} SES and O3b, for their part, argue that the Commission must further study aggregate interference and establish a mechanism by which to address occurrences of harmful interference in order to meet its obligations.^{92/} These claims overstate international law. Article 45 of the ITU's Radio Regulations requires that the Commission not permit use of spectrum that would cause harmful interference "to the radio services or communications of other [ITU] Member States . . . which operate in accordance with the provisions of the Radio Regulations." However, as noted above, there is no evidence that UMFUS operations will cause any harmful interference into satellite receivers. The Commission is therefore complying with its obligations to protect foreign-authorized satellites, and it should reject proposals that it adopt additional requirements regarding interference and transmit power levels.

^{90/} See *Report and Order*, ¶ 69.

^{91/} SIA Petition at 12-13.

^{92/} SES and O3b Petition at 23-24.

V. CONCLUSION

T-Mobile appreciates the action the Commission has taken in the *Report and Order* to make much needed spectrum available for mobile terrestrial use. Consistent with its goal in this proceeding to promote the development of 5G terrestrial mobile wireless technologies, and in keeping with its reasoning in the *Report and Order*, the Commission should reject the Petitions for Reconsideration filed by the FSS proponents: SES, O3b, the SIA, ViaSat, EchoStar, Inmarsat, and Boeing.

Respectfully submitted,

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January 31, 2017

CERTIFICATE OF SERVICE

I, Radhika U. Bhat, hereby certify that on January 31, 2017 a copy of the foregoing Opposition of T-Mobile USA, Inc. was served by first-class mail, postage paid, on each of the following:

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